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Thinking fast and slow in medicine

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A 30-year-old man, we will call him Ned, accidentally swallowed a piece of bone while eating chicken stew. He noted mild discomfort, which improved as he finished his meal. He never mentioned this to his family or to the professionals who subsequently cared for him. The next morning, he noted a mild persistent aching and pressure in his chest. His wife remembered a nearby freestanding emergency room that advertised short wait times and friendly service. He went there at his wife's insistence.

A good-looking nurse with blond surfer hair and a reassuring smile guided him to an exam room and took his vital signs. "My name is Ron," the nurse said as he recorded the heart rate, 100 beats per minute—a little fast. Blood pressure was a bit low, 90/50 mm Hg. "Do you have any medical problems? Take any medications? Have any allergies? You say you haven't had anything to eat or drink this morning?" He answered "no" to all.

Ned relaxed. This was a big fuss over nothing. And besides, the pain in his chest was getting better. He wanted to make his wife happy. She was the worrier and insisted that he stay home from work. With luck he would be home before lunch with a clean bill of health.

"I am going to draw some blood. We are going to check troponins and do an electrocardiogram just to make sure," said Ron. "Dr. Brown will be in soon to check you out." Ned smiled and nodded, though he had no idea what a troponin was. He did understand they wanted to make sure he wasn't having a heart attack. A tourniquet circled his left arm and pulled tight. Cool alcohol swabbed his skin. He braced for the sharp metallic stick and watched as two small glass tubes filled with his blood. A razor removed hair from his chest. Sticky patches were applied, trailing wires that ran back to a device that looked like an oversized laptop. It shook and whirled as paper emerged from its side. Nurse Ron tore off the EKG and gave it a quick glance. "Looks good. Dr. Brown will be in to see you soon."

The TV on the far wall was tuned to a home remodeling show, though the sound was off. In the distance he could hear the muffled conversations of strangers. After a few minutes, the door opened and a young physician introduced herself. "I am Dr. Brown. What brings you in today?" she asked, trying to sound upbeat. She was in the final year of her residency and was coming off a week of nights on the intensive care unit at a local teaching hospital. Doing extra work in the ER paid well and was not too demanding. She mostly saw the worried well.

"Doc, nothing really. To be honest, my wife insisted I come down and get checked out. I just woke up with a little pain in my chest. It is probably just something I ate last night that didn't agree with me."

"Do you have nausea? Vomiting? Diarrhea?" He shook his head.

She sat down, turned to face a large computer monitor, and began to type on the keyboard. "Let me log in. Here we go." She glanced over her shoulder at the TV behind Ned. The granite pattern being installed in the kitchen looked amazing. She looked forward to home ownership. But first she must complete her training and pay off her student loans.

She returned to the computer and typed as she spoke, asking a sequence of questions. Is there a history of heart disease in his family? Does he have a history of high blood pressure, diabetes, or high cholesterol? Does Ned smoke or use drugs?

"No" came the answer to all questions.

"I have to ask you a few extra questions. Have you experienced a fall in the last 30 days? Do you feel safe in your home?" Her phone vibrated and she paused to look at it. "Excuse me. The tests just came back on another patient. I will be right back."

She returned without explanation 20 minutes later and handed him a form. "Please fill out this brief questionnaire we use to screen for anxiety and depression."

He took the sheet, quickly marking that he did not feel helpless or hopeless and was not thinking of injuring himself.

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Dr. Brown retrieved the paper and sat down again, typing as she talked.

"Using our risk calculator, your chance of having a heart attack within the next 10 years is low, less than 1%." That was good to know.

"Your EKG is normal, and the blood work is negative for troponin. We will check it again in a few hours before sending you home. I am going to refer you for a cardiology consultation just to make sure. But I think you are fine. Do you have any questions?"

Troponin? He guessed that not having that was a good thing. He had to see a cardiologist? Was that a heart doctor? He had a lot of questions. "No. I think it was just something I ate."

"Happens to all of us at one time or another," Dr. Brown replied as she stood and turned to face him. "It was a pleasure to meet you. You are free to go once we get the second set of bloodwork back so long as your troponin remains negative." She shook his hand, walked to a hand sanitizer, squeezed a large dollop of white foam into her hands, and exited the room.

He got home in the early afternoon, telling his wife he had checked out okay. "They still want me to see some specialist though it isn't an emergency and probably isn't anything at all," he explained. And that, he thought to himself, was never going to happen. He was fine. "I feel a bit tired. I am going to lie down and sleep."

His wife woke the next morning to soft groans. Ned was sweaty and shaking. His eyes looked wild and he didn't recognize her. His mind was adrift on a tossing ocean of sweat and nausea. His chest burned.

The paramedics came quickly, efficiently transferring him to a stretcher and whisking him out of the house and into the ambulance. Sleepy-eyed neighbors stood and gawked. A notice was posted online to Next-Door Neighbor. "Does anyone know what happened to Ned Smith this morning? Did he have a heart attack?"

A computed tomography of the chest at the local hospital showed the esophageal perforation and its consequences. Air and pus surrounded the esophagus. Fluid had started to fill the mediastinum and was collecting around both lungs. Within 4 hours, Ned Smith died from overwhelming sepsis and multiorgan failure.

This case is real, though names and details have been changed. It leaves the reader with a simple question: Why did modern medicine fail Ned?

Was Dr. Brown incompetent? Did Ned play a role? His death is perhaps best understood as an error of cognition, rather than of ignorance or neglect. It is estimated that as many as 75% of medical mistakes result from cognitive errors.[1]

Psychologists have demonstrated that the human brain uses shortcuts to perform the rapid decisions we need to navigate life. We must constantly make decisions in the absence of adequate information. To do otherwise would result in paralysis. The psychologists Stanovich and West described two modes of human decision making.[2] The first, which they termed System 1, allows rapid, automatic, unconscious decision making. It requires little energy or attention but is prone to bias and systemic error. It is efficient and allows us to make rapid decisions with minimal information. Good examples are walking on a sidewalk or driving a car, activities that require little active thought or conscious effort. System 1 is easy and fast.

System 2 involves slow, effortful, and controlled decision making. It cannot work without focused attention. It takes effort and can be exhausting. Examples include public speaking or taking a math test.

The Nobel Prize–winning psychologist Daniel Kahneman was among the first to note that not only is human cognitive capacity limited, but it is prone to error when overtaxed.[3] This can happen when physicians perform multiple unrelated tasks while making decisions. Dr. Brown must manage several patients at once; she is tired and must manually enter data into a computer. Requirements for documentation can be excessive, requiring evaluation and documentation of irrelevant history, review of systems, and physical exam points. These activities require cognitive energy, but do not help Dr. Brown reach the correct diagnosis.

Daniel Kahneman and his collaborator Tversky identified three common sources of error, so-called heuristics, though others have since been described.[3]

The first they termed *availability*, a mental shortcut that relies on recent examples when evaluating a decision. In Ned's case, the fact that an ER physician sees a large number of young worried well and rarely sees life-threatening disease in these individuals creates a bias. So too does the fact that Dr. Brown regularly sees individuals with chest pain related to ischemic heart disease, making this the focus of her investigation. She focuses on eliminating an unlikely but serious diagnosis. Her intuition tells her that the patient has nothing serious, possibly indigestion, and is only in the ER to make his wife happy.

A second heuristic is *representativeness*, which is an error in estimating probability under uncertainty. This involves grouping a decision with others that have similar characteristics and wrongly estimating likelihood. In this case, Dr. Brown groups Ned with the large group of similar young patients who have negative testing for acute myocardial infarction. She correctly calculates that his chance of myocardial infarction is extremely low. What she fails to recognize is that he actually belongs to a group of patients who have swallowed sharp objects, in this case a broken chicken bone, placing them at high risk for esophageal perforation. Both she and her patient are to blame here. Ned failed to mention the onset of pain while eating stew or his suspicion that he had swallowed a small bone. Yet, Dr. Brown also failed to ask the right questions. As often happens, details about onset, duration, and possible mechanisms were not explored. In addition, there was premature closure, that is to say, jumping to a conclusion before all relevant information has been obtained.

The chicken bone might have been easily identified on a simple chest x-ray, had one been obtained. However, both physician and patient were convinced that nothing was seriously wrong. The ability of one person's beliefs to infect another was described by 19th century French physicians Charles Lasegue and Jean-Pierre Falret, who coined the term *folie au deux* (roughly translated as double delusion). It has come to define a psychiatric syndrome in which a delusion or hallucination is transmitted from one person to another.

The third heuristic is termed *anchoring*. This occurs when individuals rely too heavily on initial information to anchor the starting point for decision making. In this case, the patient thought he was okay and reported that his wife insisted he be checked. This served to minimize the chance of serious illness in the minds of both nurse and physician. It also fit a narrative of a worried well seeking medical attention in an ER "just to make sure." Over 85% of patients seen in freestanding ERs walk in without the assistance of ambulance or emergency personnel. Fewer than 5% are found to be seriously ill.[4]

A number of factors reduce Dr. Brown's cognitive capacity. She was seeing multiple patients within a limited time frame. She was tired. She had to multitask, simultaneously entering information into the electronic health record while interviewing Ned. Well-meaning bureaucrats have added an increasing number of questions and documentation not pertinent to establishing a diagnosis. "Do you feel safe in your home?" is but one example. Dr. Brown's cell phone pinged, nurses interrupted, and she may have even been distracted by a TV. Her time with Ned, like that spent with most patients, was interrupted and hurried. She was not ignorant or poorly trained. She experienced cognitive overload.

Ideally Ned's evaluation should have taken place in a calm, quiet space, with Dr. Brown focused only on him. No cell phones, no calls, no pages, no TV, and no interruptions. Physicians train in chaotic environments and are chosen for their resilience. The ability to work without sleep, food, or rest is a highly prized virtue that differentiates the best from the rest. To say no or set boundaries shows weakness. A physician quickly learns that there is no limit to how many patients she might see in a day. Sleep and rest are luxuries. Today's physicians are expected to enter data, multitask, make patients happy, choose wisely, and of course make a correct diagnosis and recommend appropriate therapy.

Human cognition is limited, yet health care systems require physicians to quickly and efficiently complete multiple unrelated tasks simultaneously. We must respond to phone calls, texts, emails, and the odd knock on our exam room door while processing information for multiple patients with diverse conditions. Physicians do this while manually entering data into computers and trying to remain empathetic, lest patient satisfaction scores fall. It is no surprise that errors occur. It is a testament to the dedication and commitment of health care providers that these are uncommon. Additional years of training, continuing medical education, and surveillance by state medical boards cannot solve the problem. If cognitive error is to be eliminated, the very practice of medicine must be redesigned and reinvented.

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